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Team 6: System of Systems Test Planning in a Joint Mission Environment

Maheu, S.

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TEAM 6 MEMBERS

S. MAHEU, LTC, – Lead, Contact[1]
US Army, JTEM Office, USA

T. BEACH
E. BJORKMAN, COL
JTE, OSD, USA

L. CLITES
G. HORNE
S. UPTON
Referentia Systems Inc., USA

O. SENDSTAD
FFI, Norway

C. WEGNER, MAJ.
Naval Postgraduate School, USA

PROPOSAL ABSTRACT

The concept of system-level testing of defense acquisition programs has changed. While system level testing remains necessary, it is no longer sufficient for making meaningful acquisition decisions. DoD planning guidance directs that test and evaluation activities include tests in joint environments. This will require acquisition program managers to conduct testing in environments where their new system is a participant in an overarching, joint system of systems. Such a test environment may include live assets along with virtual and constructive simulations. One can immediately recognize the difficulties of such testing. Planning and designing system of system tests is complex due to the need to replicate an entire mission environment, and the number of potential factors that could affect results or outcomes. Agent based simulation and Data Farming are methods that can help testers determine which factors significantly affect mission outcomes and which do not. This, in turn, allows testers to focus scarce resources on the most important test conditions.

The scenario we started with during IDFW 13 was one involving close air support (CAS). CAS is air action by fixed- and rotary-wing aircraft against hostile targets that are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces. The particular joint environment of interest in this phase includes adverse weather, Army and Marine ground elements, Air Force and Navy aircraft, adversary air defense systems with modern surface-to-air missiles (SAMs) and artillery, and adversary anti-precision-guided munitions (PGM) systems employing cover, concealment, camouflage, decoys, and deception. Joint forces will use a joint network-enabled command, control, intelligence, surveillance, and reconnaissance (NEC2ISR) structure to process CAS requirements.

In this scenario, the targets will be both mobile and static. Targets can be detected by airborne and ground based sensors. Target information is transmitted via data link to the NEC2ISR structure for processing. The command and control element will use target information in the CAS request, together with information available on the network, to select CAS aircraft. CAS aircraft will receive information about the target and the specific joint terminal attack controller (JTAC) who will provide third-party targeting. Using information from the C2 network, the CAS aircraft releases a NEW within the computed launch acceptable region (LAR). The JTAC continues to track the target and sends updated target locations through the weapon control network. The NEW recognizes updated target locations (or new targets) from its assigned JTAC (while ignoring target locations from other JTACs) and guides to the assigned target.

Our work during IDFW 13, contributed to insight on the following question: What might matter and what doesn't appear to matter in the employment of systems before actual testing takes place? Through modeling and Data Farming of the scenario and variations described above, the goal was to better understand what might be tested. The plan for the workshop was to utilize MANA, Pythagoras, and perhaps other models to model the scenario and excursions. The plan was then to use data farming methodology to

[1] For more information contact: LTC Stafford Maheu, Stafford.Maheu@kirtland.af.mil, 505 846-8318, USA

understand the possibility space for important variables in the systems under test. The work at IDFW 13 was intended to be part of a continuing process to assist in the test planning in particular and in the overall development of a Joint Test and Evaluation Methodology.

Scenario

In the joint close air support (JCAS) scenario, mobile and static targets are detected by airborne and ground based sensors. Target information is transmitted via data link to the NEC2ISR* structure for processing. The command and control element uses this target information to direct aircraft to perform JCAS. The JCAS aircraft fly to launch position and release a Network Enabled Weapon (NEW) which receives updated target information (or a different target) from a Joint Terminal Attack Controller while guiding to the assigned target.

Activities

Team 6 consisted of members representing JTEM, NPS, FFI and Referentia. The team posed the question "What might matter and what doesn't appear to matter in the test planning of a system of systems acquisition test event before actual testing takes place?" Through modeling (in MANA, Pythagoras, and NetLogo) and Data Farming the team goal was to understand the possibility space for important variables in the system of systems to be tested.

Initial Results

The work at IDFW 13 provided promising results which will lead to continued work in support of acquisition test planning. The team ran the MANA scenario in which five factors were varied over selected ranges. A regression tree plot indicated that almost 50% of the variation in the response could be attributed to the absence or presence of countermeasures in the test. Three other variables showed that each accounted for some amount of variation; while the fifth did not show any variation within the range of values over which data farming occurred. Pythagoras modeling was stopped after day three of the IDFW as there were difficulties depicting the command and control relationship with that modeling tool. Preliminary results utilizing NetLogo show significant potential. It is possible that the system of system models using both MANA and NetLogo will be viable.

Way Ahead

This effort will continue with the goal of having a model which can be utilized by JTEM during the evaluation of joint test planning activities. Future work will include the application of the model to the test planning of an actual Network Enabled Weapon test event in 2007. Additionally, an upcoming NPS thesis on the Two Phase Adaptive Sequential Factor Method will utilize and enhance this model for the purposes of test planning.